

WHAT IS CLAIMED IS:

1. A method of decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced into a decomposition area for decomposing the decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, the method comprising the steps of:

(a) introducing said decomposition promoting substance into said decomposition area;

(b) irradiating said decomposition area with light; and

(c) introducing the decomposition target substance into said decomposition area,

wherein the steps are started in the order of said steps (a), (b) and (c), the step (a) the earliest, at the time of starting the operation of decomposing said decomposition target substance,

and said steps are stopped in the order of (c), (b) and (a), the step (c) the earliest, at the time of ending the operation of decomposing said decomposition target substance.

2. The method according to claim 1, wherein said

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decomposition promoting substance is chlorine.

3. The method according to claim 2, wherein
introduction of said chlorine into said decomposition
area is carried out by supplying functional water
having a function to generate chlorine in the
decomposition area to contact the functional water with
a gas comprised of the decomposition area.

10 4. The method according to claim 2, wherein
introduction of said chlorine into said decomposition
area is carried out by introducing a gas containing
chlorine, prepared by contacting a gas supplied to an
area storing therein functional water having a function
15 to generate chlorine with the functional water existing
in the functional water storage area, into said
decomposition area.

5. The method according to claim 4, wherein
20 introduction of said decomposition target substance and
said chlorine into said decomposition area is carried
out by introducing into said decomposition area a gas
containing the decomposition target substance and
chlorine prepared by contacting a gas containing the
25 decomposition target substance supplied to said
functional water storage area with said functional
water existing in the functional water storage area.

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6. The method according to claim 5, wherein
introduction of said decomposition target substance and
said chlorine into said decomposition area is stopped
by substituting a gas not containing the decomposition
5 target substance for the gas containing the
decomposition target substance to be supplied to said
functional water storage area.

7. The method according to claim 4, wherein the
10 functional water contains hypochlorous ion.

8. The method according to claim 4, wherein the
functional water is acidic water produced in the
vicinity of the positive electrode by electrolysis of
15 water containing an electrolyte.

9. The method according to claim 8, wherein the
electrolyte is at least one selected from the group
consisting of sodium chloride and potassium chloride.
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10. The method according to claim 4, wherein the
functional water is a mixture of acidic water produced
in the vicinity of the positive electrode and alkaline
water produced in the vicinity of the negative
25 electrode by electrolysis of water containing an
electrolyte.

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11. The method according to claim 10, wherein the mixture is obtained by mixing the acidic water with the alkaline water at an acidic water to alkaline water ratio of 1 : 1 or lower by volume.

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12. The method according to claim 4, wherein the functional water is a hypochlorite solution.

10 13. The method according to claim 12, wherein the hypochlorite is at least one selected from the group consisting of sodium hypochlorite and potassium hypochlorite.

15 14. The method according to claim 12, wherein the functional water further contains an inorganic acid or an organic acid.

20 15. The method according to claim 14, wherein the inorganic acid or organic acid is at least one compound selected from the group consisting of hydrochloric acid, fluoric acid, sulfuric acid, phosphoric acid, boric acid, acetic acid, formic acid, malic acid, citric acid and oxalic acid.

25 16. The method according to claim 4, wherein for the functional water, the hydrogen-ion concentration (pH value) is in the range of from 1 to 4, the

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oxidation-reduction potential (working electrode: platinum electrode, reference electrode: silver-silver chloride electrode) is in the range of from 800 to 1500 mV, and the concentration of chlorine is in the range 5 of from 5 to 150 mg/L.

17. The method according to claim 4, wherein for the functional water, the hydrogen-ion concentration (pH value) is in the range of from 4 to 10, the 10 oxidation-reduction potential (working electrode: platinum electrode, reference electrode: silver-silver chloride electrode) is in the range of from 300 to 1100 mV, and the concentration of chlorine is in the range of from 2 to 100 mg/L.

15 18. The method according to claim 4, wherein introduction of said decomposition target substance into said decomposition area is stopped by substituting a gas not containing the decomposition target substance 20 for the gas to be supplied to said functional water storage area.

19. The method according to claim 1, wherein the light includes light with wavelengths in the range of 25 from 300 to 500 nm.

20. The method according to claim 19, wherein the

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light includes light with wavelengths in the range of from 350 to 450 nm.

21. The method according to claim 1, wherein the
5 amount of the light with which the irradiation is carried out is in the range of from 10 $\mu\text{W}/\text{cm}^2$ to 10 mW/cm^2 .

22. The method according to claim 21, wherein the
10 amount of the light with which the irradiation is carried out is in the range of from 50 $\mu\text{W}/\text{cm}^2$ to 5 mW/cm^2 .

23. The method according to claim 1, wherein said
15 decomposition target substance is a halogenated aliphatic hydrocarbon compound.

24. The method according to claim 23, wherein
said halogenated aliphatic hydrocarbon compound is an
20 aliphatic hydrocarbon compound comprised of an atom substituted with chlorine atom.

25. The method according to claim 24, wherein the
halogenated aliphatic hydrocarbon compound is at least
one selected from the group consisting of
trichloroethylene, 1,1,1-trichloroethane,
chloroethylene, tetrachloroethylene, 1,1-

dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, trichloromethane (chloroform) and dichloromethane.

5 26. An apparatus for decomposing substances to be
decomposed in which a decomposition target substance
and a decomposition promoting substance having a
function to decompose said decomposition target
substance under irradiation with light are introduced
10 into a decomposition area for decomposing the
decomposition target substance, and those substances
are contacted with each other under irradiation with
light to decompose the decomposition target substance,
comprising:
15 a decomposition unit comprised of the
decomposition area;
 a decomposition promoting substance introduction
unit (d) for introducing said decomposition promoting
substance into said decomposition area;
20 a light-irradiation unit (e) for irradiating said
decomposition area with light;
 a decomposition target substance introduction unit
(f) for introducing said decomposition target substance
into said decomposition area; and
25 a drive unit for driving said decomposition
promoting substance introduction unit (d), said light-
irradiation unit (e) and said decomposition target

substance introduction unit (f) individually,

wherein said drive unit starts driving said decomposition promoting substance introduction unit (d), said light-irradiation unit (e) and said

5 decomposition target substance introduction unit (f) in the described order at the time of starting the operation of decomposing said decomposition target substance,

and stops said operated decomposition target 10 substance introduction unit (f), said operated light-irradiation unit and (e) said operated decomposition promoting substance introduction unit (d) in the described order at the time of ending the operation of decomposing said decomposition target substance.

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27. The apparatus according to claim 26, wherein said drive unit carries out said starting and said stopping in accordance with a program preset in a computer.

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28. A method of decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target 25 substance under irradiation with light are introduced into a decomposition area for decomposing the decomposition target substance, and those substances

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are contacted with each other under irradiation with light to decompose the decomposition target substance, the method comprising the steps of:

- (a) introducing said decomposition promoting substance into said decomposition area;
- 5 (b) irradiating said decomposition area with light; and
- (c) introducing the decomposition target substance into said decomposition area.

10 wherein the steps are started in the order of said steps (a), (b) and (c), the step (a) the earliest, at the time of starting the operation of decomposing said decomposition target substance.

15 29. A method of decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced
20 into a decomposition area for decomposing the decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, the method comprising the steps of:

- 25 (a) introducing said decomposition promoting substance into said decomposition area;
- (b) irradiating said decomposition area with

substance into said decomposition area;

a light-irradiation unit (e) for irradiating said decomposition area with light;

a decomposition target substance introduction unit

5 (f) for introducing said decomposition target substance
into said decomposition area; and

a drive unit for driving said decomposition promoting substance introduction unit (d), said light-irradiation unit (e) and said decomposition target substance introduction unit (f) individually,

10 substance introduction unit (f) individually,

wherein said drive unit stops said operated decomposition target substance introduction unit (f), said operated light-irradiation unit and (e) said operated decomposition promoting substance introduction unit (d) in the described order at the time of ending the operation of decomposing said decomposition target substance.

light; and

(c) introducing the decomposition target substance into said decomposition area,

5 wherein the steps are stopped in the order of said steps (c), (b) and (a), the step (c) the earliest, at the time of stopping the operation of decomposing said decomposition target substance.

30. An apparatus for decomposing substances to be 10 decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced into a decomposition area for decomposing the 15 decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, comprising:

20 a decomposition unit comprised of the decomposition area;

a decomposition promoting substance introduction unit (d) for introducing the decomposition promoting substance into said decomposition area;

25 a light-irradiation unit (e) for irradiating said decomposition area with light;

a decomposition target substance introduction unit (f) for introducing said decomposition target substance

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into said decomposition area; and
a drive unit for driving said decomposition
promoting substance introduction unit (d), said light-
irradiation unit (e) and said decomposition target
5 substance introduction unit (f) individually,
wherein said drive unit starts driving said
decomposition promoting substance introduction unit
(d), said light-irradiation unit (e) and said
decomposition target substance introduction unit (f) in
10 the described order at the time of starting the
operation of decomposing said decomposition target
substance.

31. An apparatus for decomposing substances to be
15 decomposed in which a decomposition target substance
and a decomposition promoting substance having a
function to decompose said decomposition target
substance under irradiation with light are introduced
into a decomposition area for decomposing the
20 decomposition target substance, and those substances
are contacted with each other under irradiation with
light to decompose the decomposition target substance,
comprising:

a decomposition unit comprised of the
25 decomposition area;
a decomposition promoting substance introduction
unit (d) for introducing the decomposition promoting